Pace University

CS 608 Algorithms and Computing Theory

Fall 2020

Instructor

Prof. Miguel A. Mosteiro, PhD
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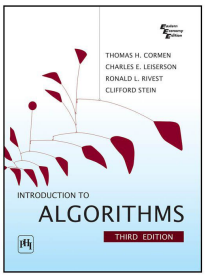
Email: mmosteiro@pace.edu
Office Location: room 232 @ 163 William St. Currently online meetings only.
Office Hours: Tue & Thu 9:30am-noon

Prerequisite	A grade of C or better in CS 504, and those specified in Section Course Requirements
Credits	3
CRN	73441
Meeting	Thursday 6:10pm - 9:00pm ONLINE SYNCHRONOUS, CAMERA AND MICROPHONE REQUIRED.

Description

The purpose of this course is to acquire a thorough grounding in the core principles and foundations of computer science. Students will learn methods for expressing and comparing algorithm complexity (worst- and average-case upper bounds, lower bounds) as well as to verify correctness. Algorithm-design techniques (divide-and-conquer, dynamic programming) as well as data structures (trees, heaps, hash tables) widely used in modern software development will be studied. The knowledge gained will be applied to a variety of practical problems, such as searching, sorting, and graph problems (shortest paths, minimum spanning trees). The question of what problems are hard to compute will be addressed with an introduction to NP-completeness theory, including the development of the NP-complete classification and the identification of NP-hard problems by reductions.

Textbook Required



T. H. Cormen, C. E. Leiserson, R. L. Rivest, C. Stein. ***Introduction to Algorithms, 3/E,*** MIT Press, 2009, ISBN: 9780262033848

Textbooks Recommended

Robert Sedgewick & Kevin Wayne. ***Algorithms, 4/E,*** Pearson, 2011, ISBN: 9780321573513

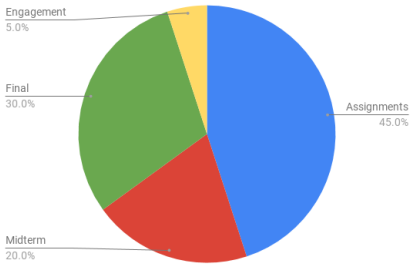
Anany Levitin. ***Introduction to the Design and Analysis of Algorithms, 3/E,*** Pearson, 2011, ISBN: 9780132316811

Learning Outcomes (assessed student outcomes: a, b, c)

1) ability to analyze efficiency of algorithms and data structures [a];
2) ability to utilize and/or design data structures in problem solving [b];
3) ability to devise correct algorithms using various algorithm design techniques [b,c];
4) understand the difference between inefficient algorithms and “hard” problems [a].

Evaluation

Assignments	45%
Midterm exam	20%
Final exam	30%
Class engagement	5%



Grading Scale

Source: graduate catalog

A, A-	90-100%
B+, B, B-	80-89%
C+, C	70-79%
C-, D+, D	60-69%
F	0-59%

Course Requirements

Knowledge of basic data structures (arrays, lists, stacks, and queues) is assumed, as well as basic discrete mathematics (proof by induction, permutations, logarithms). Students not familiar with these topics must talk with the instructor before taking the class.

Course Policies

A camera and a microphone are required for this class. Class engagement is an important part of the final grade. No late work will be accepted without permission in advance from the instructor. There will be no make-up test given without permission in advance from the instructor. All work turned in under your name must be your own.

Tentative Schedule

Week 1 Foundations (Reading and Exercises: App A & B, and Ch 3)
The role of algorithms in computing. Summations, sets, relations, functions. Growth of functions. Asymptotic notation and common functions for running time.

Week 2 Divide and Conquer (Reading and Exercises: Ch 4)
Recursive Functions. Solving recurrences by substitution and master methods.

Week 3 Trees (Reading and Exercises: Ch 12 & 13)
Binary search trees, Self-adjusting binary search trees.

Week 4 Hash tables (Reading and Exercises: Ch 11)
Hash functions. Chaining and probing.

Week 5 Priority queues (Reading and Exercises: Ch 6)
Binary heap.

Week 6 **Test 1**

Week 7 Sorting (Reading and Exercises: Ch 6 & 7)
Merge sort, Heap sort, and Quick sort.

Week 8 Sorting in Linear Time (Reading and Exercises: Ch 8)
Lower bound for comparison-based sorting. Counting sort, Radix sort, and Bucket sort.

Week 9 Dynamic Programming (Reading and Exercises: Ch 15)
Rod cutting. Longest common subsequence. Optimal binary search trees.

Week 10 Graph Algorithms. (Reading and Exercises: Ch 22)

Data Structures for Graphs. DFS, BFS, Topological sort. Strongly-connected components.

Week 11 Minimum spanning trees. (Reading and Exercises: Ch 23)

Kruskal and Prim algorithms.

Week 12 Shortest Paths Algorithms (Reading and Exercises: Ch 24)

Bellman-Ford and Dijkstra algorithms.

Week 13 NP-Completeness (Reading and Exercises: Ch 34)

Polynomial-time verification. NP-completeness and reducibility.

Week 14 **Test 2**

University Policies and Resources (as of 8/6/2020)

Academic Integrity

Students in this course are required to adhere to Pace University's Academic Integrity Code. The Academic Integrity Code supports honesty and ethical conduct in the educational process. It educates students about what constitutes academic misconduct, helps to deter cheating and plagiarism, and provides a procedure for handling cases of academic misconduct. Students are expected to be familiar with the Code, which can be found under "University Policies" in the Student Handbook. Individual schools and programs may have additional standards of academic integrity. Students are responsible for familiarizing themselves with the policies of the schools, programs, and courses in which they are enrolled.

Learning Centers

The Learning Center uses an array of programs and a holistic approach to assist students with academic skills and content knowledge. We are dedicated to developing independent learners by creating purposeful interactions with trained, well-qualified peer and professional staff.

Procedure for Students Who Wish to Obtain Reasonable Accommodations for a Course:

The University's commitment to equal educational opportunities for students with disabilities includes providing reasonable accommodations for the needs of students with disabilities. To request a reasonable accommodation for a qualified disability a student with a disability must self-identify and register with Student Accessibility Services for his or her campus. No one, including faculty, is authorized to evaluate the need for or grant a request for an accommodation except Student Accessibility Services. Moreover, no one, including faculty, is authorized to contact Student Accessibility Services on behalf of a student. For further information, please see Resources for Students with Disabilities page.

Technological Resources:

- List of all Pace Information Technology Services.
- For assistance with a technological concern (Blackboard, Internet, Computer, etc.), contact the Pace Helpdesk at 914-773-3648 or create a help desk ticket.
- Visit the Learning Remotely website

Appropriate Use Policy for Information Technology:

Pace endorses the following statement on software and intellectual rights distributed by EDUCAUSE, the non-profit consortium of colleges and universities, committed to the use and management of information technology in higher education. The statement reads:

> *Respect for intellectual labor and creativity is vital to academic discourse and enterprise. This principle applies to work of all authors and publishers in all media. It encompasses respect for the right to acknowledgment, right to privacy and right to determine the form, manner and terms of publication and distribution.*
>
> *Because electronic information is volatile and easily reproduced, respect for the work and personal expression of others is especially critical in computer environments. Violations of authorial integrity, including plagiarism, invasion of privacy, unauthorized access and trade secret and copyright violations, may be grounds for sanctions against members of the academic community.*

Pace's appropriate use policy applies to recordings of classroom instruction and digital artifacts created by faculty and students.

Sex-Based Misconduct Policy and Procedure:

Pace University is committed to providing a safe environment for every member of its community and to ensuring that no student, faculty or staff member is excluded from participation in or denied the benefits of any University program or activity on the basis of sex. Accordingly, the University prohibits the following forms of Sex-Based Misconduct: sexual assault, sexual harassment, gender-based harassment, dating violence, domestic violence, sexual exploitation and stalking.

Instructors are a **non-confidential** resource and have an obligation to report any information about sexual assault with Ms. Lisa Miles, Executive Director of Institutional Equity and Title IX Coordinator (163 Williams Street, Room 1017, 212-346-1310, amiles@pace.edu). The Title IX/Affirmative Action Office is responsible for investigating violations of the sexual misconduct policy. For more information about the Pace University sexual misconduct policy, see the Sex-Based Misconduct Policy and Procedure (PDF).

Members of the University community who believe that they have been subjected to Sex-Based Misconduct are encouraged to report such incidents to the University and, where applicable, to local law enforcement. **Confidential** resources include the **University Counseling Centers, Offices of Sexual and Interpersonal Wellness** and **University Healthcare**. Contact information for those offices may be found in the self-care section below.

Self-Care:

Your academic success in this course and throughout your college career depends heavily on your personal health and well-being. Stress is a common part of the college experience, and it often can be compounded by unexpected life changes outside the classroom. The Pace Community strongly encourages you to take care of yourself throughout the term, before the demands of midterms and finals reach their peak. Please feel free to talk with me about any difficulty you may be having that may impact your performance in this course as soon as it occurs and before it becomes unmanageable. Please know there are a number of other support services on campus that stand ready to assist you. I strongly encourage you to contact them when needed.

Department	**Pleasantville**	**New York City**
Counseling Center	914-773-3710	212-346-1526
Dean for Students Office	914-773-3351	212-346-1306
Health Care Unit	914-773-3760	212-346-1600
Residential Life	914-923-2791	212-346-1295
Student Development and Campus Activities	914-773-3861	212-346-1590
Office of Multicultural Affairs & Diversity Programs	914-773-3775	212-346-1563
Sexual Assault Prevention & Education	914-597-8783	212-346-1931
Academic Advisement		
Advising Center for Exploring Majors	914-773-3847	212-346-1798
College of Health Professions	914-773-3961	914-773-3552
Dyson College	914-773-3781	212-346-1518
International Student / Scholars	914-773-3425	212-346-1368
Lubin School of Business	914-773-3531	212-618-6550
Pforzheimer Honors College	914-773-3941	212-346-1697
Seidenberg School	914-773-3254	212-346-1864
Study Abroad	914-773-3447	212-346-1368